March 16, 1871.

General Sir EDWARD SABINE, K.C.B., President, in the Chair.

The following communications were read :—

I. "Description of *Ceratodus*, a genus of Ganoid Fishes, recently discovered in rivers of Queensland, Australia." By ALBERT GÜNTHER, M.A., Ph.D., M.D., F.R.S. Received February 7, 1871.

(Abstract.)

After some introductory remarks the author proceeds to give a description of the external characters which appear to indicate the existence of two species, viz. *Ceratodus forsteri*, with fewer and larger, and *Ceratodus miolepis* with smaller and more numerous scales. The microscopical structure of the scales and teeth is treated of in two separate chapters, the latter being compared with the fossils from the Triassic and Jurassic formations, and found to be identical. The resemblance to the dentition of *Protopterus*, *Psammodus*, *Dipterus* and other fossil genera is pointed out.

The *skeleton* resembles in its general characters, as well as in numerous points of detail, so much that of *Lepidosiren*, that from this part alone the conclusion must be drawn that these genera belong to the same natural group of fishes. It is notochordal, all its parts having a cartilaginous basis, more or less incompletely covered by thin osseous lamellæ.

The ossifications of the skull are but few in number, and may be designated thus :—*ethmoid*; a pair of *frontals* separated by a single "*sclero-parietal*"; basal, with a tooth-bearing *pterygo-palatine* on each side, the latter bones being suturally united in front; *vomer* cartilaginous, tooth-bearing. *Maxillary* and *intermaxillary* elements are not developed, replaced by facial cartilages which are confluent with the suborbital ring, all these parts being cavernous. *Tympanic pedicle* cartilaginous, with ossified lamella (*os quadratum*) and double condyle. *Mandible* with an *articulary* and *dentary* lamella. *Præoperculum* a rudimentary moveable cartilage. A well-developed *operculum* and styliform *suboperculum*. *Hyoid arch* more complex than in *Lepidosiren*, consisting of a pair of ceratohyals, a basi- and glosso-hyal. *Branchial apparatus* composed of five arches, of which the last is rudimentary ; not differing from the Teleosteous type, but cartilaginous. In a vertical section of the head the parts of the brain-cavity and of the *acoustic* cavity (which is entirely enclosed in the skull) are explained. A pituitary gland is present.

The notochord forms the base for about 68 sets of *apophyses*, 27 of which bear ribs. The various modifications in the different parts of the column are described in detail ; and more especially attention is directed to the first rib, which is very similar to that of *Lepidosiren*, where, from its more intimate connexion with the skull, it was interpreted in various

ways, for instance by Mr. Parker as the "large first pharyngo-branchial." Arrangement and detachment of dermoneurals as in *Lepidosiren*.

The scapular arch and pelvis are more developed than, but typically entirely identical with, those of *Lepidosiren*.

The *paddles* are supported by a cartilaginous axial skeleton, that is, by a longitudinal series of joints, with lateral divergent articulated branches, each joint having two of these branches. The relations of this singular structure to the corresponding parts in *Lepidosiren* and Selachians are explained; and there is no doubt that the Ganoids of the Devonian epoch, with *acutely* lobate fins, had their paddles supported by a similar internal skeleton.

Eye without falciform process or choroid gland.

Heart.—The arrangements of the interior of the ventricle and single atrium, and the external appearance of the bulbus arteriosus, are very similar to the same parts in *Lepidosiren*; but the valvular arrangement of the bulbus is more "Ganoid," though considerably modified. We find at a short distance from the origin of the bulbus, first, a single, cartilaginous, papillary valve worked by a special muscle, then a transverse series of four small short valves (sometimes reduced to papillæ), then a transverse series of four oblong raised strips (rudimentary valves), finally a transverse series of four well-developed "Ganoid" valves. Four *arcus aortæ* enter the four gills, without sending off branches, and four *venæ branchiales* are collected into the *aorta descendens*.

A description of the principal portions of the circulatory system follows.

The *gills* are completely developed, four in number, lamellated. The pseudobranchia does not receive its blood from the heart; thus an "opercular gill" is absent as well as spiracles.

The *lung* is single, but its cavity divided into two symmetrical halves, each with about thirty cellular compartments; pneumatic duct and glottis as in *Lepidosiren*; its dorsal artery is a branch of the *A. cœliaca*; and its vein enters the atrium separately from the sinus venosus.

The most important points of the structure of the remaining soft organs are the following:—the *intestinal tract* is perfectly straight and very wide, with a complete spiral valve, along the axis of which large glands are imbedded; the stomach is indicated only by a shallow double pyloric fold; there are no pyloric appendages, but a glandular mass appears to represent the spleen. Not only the *liver*, but also the paired, lobed *kidneys* are provided with a portal system. The two ureters enter by a single opening a small urinal cloaca situated at, and partly confluent with, the back of the rectum. *Testicles* without developed vas deferens, which appears to be represented by a blind duct, traversing the interior of the testicle, and receiving the semen from the canaliculi seminiferi. *Ovaries* transversely laminate, the laminæ being the bearers of the stroma in which very small ova are developed; the ova fall into the abdominal cavity, and are expelled by a pair of wide peritoneal slits behind the vent. But there

are also a pair of narrow oviducts, with or without a narrow peritoneal opening, each confluent with the ureter of its side.

In the concluding chapters it is shown :—

1. That *Ceratodus* and *Lepidosiren* (*Protopterus*) are more nearly allied to each other than to any third living fish, that they are well-marked modifications of the same (Dipnoous) type, the latter genus diverging more towards the Amphibians than the former.

2. That the difference in the arrangement of the valves of the bulbus arteriosus cannot longer be considered of sufficient importance to distinguish the *Dipnoi* as a subclass from the *Ganoidei*; but that the *Dipnoi* may be retained as a suborder of *Ganoidei*.

3. That the suborder *Dipnoi* may be characterized as Ganoids with the nostrils within the mouth, with paddles supported by an axial skeleton, with lungs and gills and notochordal skeleton, and without branchiostegals.

4. That a comparison of *Teleostei*, *Chondropterygii*, and *Ganoidei* shows that the two latter divisions, hitherto regarded as subclasses, are much more nearly allied to each other than to the *Teleostei*, which were developed in much more recent epochs; and therefore that they should be united into one subclass—*Palæichthyes*—characterized thus: heart with a contractile bulbus arteriosus; intestine with a spiral valve; optic nerves non-decussating.

5. That there is very strong evidence that the suborder *Dipnoi* was represented in the Devonian and Carboniferous epochs by the genus *Dipterus* (?=*Ctenodus*); but that, although *Dipterus* has internal nostrils and even a pair of vomerine teeth (beside the molars) like the living *Dipnoi*, it must be placed as the type of a separate family of this suborder, on account of its heterocercy.

6. That the evidence with regard of *Phaneropleuron* (Huxley) is less conclusive; and that *Tristichopterus* (Egerton), with the complete segmentation of its vertebral column, must be excluded from this suborder.

7. That the suborder *Crossopterygii* (Huxley) contains two distinct types of "lobate fin," viz. the "obtusely lobate," with a transverse series of carpal cartilages, and the "acutely lobate" with an axial skeleton. Only the latter type agrees with the structure of the Dipnoous limb. But *Polypterus*, *Cœlacanthus*, &c., which are provided with fins of the former type, are genera sufficiently distinguished also by other characters, to be placed into a separate suborder.